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# **EARLY WARNING SIGNALS AND THEIR ROLE IN PREVENTING BANKING CRISES. THE CZECH REPUBLIC CASE.**

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## **Introduction**

In recent decades many countries have experienced banking crisis, for example Mexico (1994-1995), East Asian countries (after 1997) and transition economies (in 1990's). The Czech Republic can not be omitted.

The aim of this article is to characterise the role of early warning signals in measuring the vulnerability of countries to systemic banking crisis and to analyse how successfully these indicators could have been able to predict the banking crisis in case of Czech Republic.

The first part of this paper defines the term banking crisis and describes indicators of banking crisis. The content of the second part of the paper are the individual early warning signals. The next part contains the characteristics of banking crisis in the Czech Republic. The last chapter tries to analyse the level of success of early warning signals in predicting the banking crisis in the Czech Republic.

## **Theoretical aspects of banking crisis**

A systemic banking crisis is a situation in which most of the banking sector is affected by financial distress. As an indicator of such situation can act:

- the level of nonperforming (in other words classified) loans higher than given threshold: Caprio and Klingebiel (1997) exercise 5 – 10 % of total loans; Goldstein and Turner (1996) determine the threshold as 15 – 20 % of total loans;
- costs of the crisis paid from the government budget higher than given threshold: Caprio and Klingebiel (1997) apply as the threshold 2 % of GDP; Goldstein and Turner (1996) exercise 5 % of GDP<sup>1</sup>;
- intervention acts of government, for example deposit guarantees, bank recapitalization plans, deposit freezes, nationalizations etc.;

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<sup>1</sup> It involves costs of lender of last resort function, costs connected with cleaning of banks' balance sheets by transfer of nonperforming loans, capital injections to insolvent or illiquid banks etc.

- number of bank failures;
- significant depositor runs.

Systemic banking crisis can have very painful effects and is connected with relatively high costs<sup>2</sup>. It concerns not only fiscal costs directly paid from state budget but economic costs (that means the slowdown of GDP growth) as well. Resolving such crisis is not easy<sup>3</sup>. However, the knowledge and taking advantage of early warning signals can help to predict the forthcoming crisis. Consequently, early warning indicators not only create the conditions for well-timed and adequate reactions of economic policy (it is an essential step in improving the ability of the official sector to manage and resolve banking crisis) and so mitigate the consequences of the crisis. They can act as a prevention of banking crisis as well.

### **Early warning indicators**

An early warning system contains such variables whose behaviour prior to the episode of banking crisis is systematically different from that during normal period. By monitoring these signals it is possible to detect the forthcoming crisis. As such variable can be taken a large number of indicators which are derived from the possible causes and determinants of the crisis. Following the classification of factors standing behind banking crisis, indicators of forthcoming banking crisis can be divided on macroeconomic and microeconomic as well.

The group of macroeconomic early warning signals concerns generally widespread and regularly watched indicators, such as:

- real GDP growth;
- investments;
- consumption;
- rate of inflation;
- exchange rate and its changes;
- domestic credit provided to private sector.

Before the banking crisis hit the current position of the economy is very often in the status of rapid end of a previous boom: credits to the private sectors have been built up rapidly (in many countries accompanied by the liberalization of the financial sector), after the provided credits have reached their peak the contraction follows. Such development involves the development of real GDP, consumption and investments as well: after previous rapid increase these variables suddenly start to

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<sup>2</sup> According to Honohan and Klingebiel, most costly crises were those in Indonesia (50 % of GDP), Chile (41 % of GDP), Thailand (33 % of GDP) and Uruguay (31 % of GDP)

<sup>3</sup> Possible reactions of official sector: bank recapitalization plans, capital injections, deposit guarantees, liquidity support, regulatory forbearance, debtor bailout schemes etc.

decline. The inflation rate start to growth, real interest rates increase steadily and real effective exchange rate appreciates and then depreciates<sup>4</sup>.

It is possible to ask, why although all banks in a country are exposed to the same macroeconomic conditions generally not all of them fail? The answer to this question is connected with microeconomic causes of banking crisis and therefore microeconomic (that mean banking specific) early warning signals can be applied.

The best indicators are those that are closely related to the soundness of the banking sector and of individual banks. Most often are used indicators based on items from banks' balance sheets or income statements such as:

- Capital adequacy - the level of bank capitalization and changes in bank capitalization. Bank capital acts as a cushion against potential losses, so the higher the capital adequacy ratio the lower the risk of banking crisis. The requested level of the capital adequacy depends on the riskiness of bank's assets and so reflects the bank's exposure to the credit risk, market risk and after the Basle II also operational risk. Decrease in capital adequacy ratio below the level requested by the regulator indicates the increase in solvency risk and potential financial distress.
- Asset quality. It includes repayment performance and capacity to pay of borrowers, diversification of portfolio by individual borrower, sector and country, and currency composition. Asset quality is usually measured by the level of nonperforming loans. A large share of nonperforming loans is a result of earlier poor loan decisions, poor credit policy, sometimes of deteriorating economic conditions and lack of diversification. Classified loans means potential losses for banks, banks are obliged to create loan loss provisions and it worsens bank profitability and efficiency<sup>5</sup>. Study of Gonzáles-Hermosillo (1999) conclude that problem banks had significantly higher exposures than nonproblem banks to sectors that had initially been booming but had gone bust shortly before the banking crisis hit.
- Because weak performance can ultimately threaten bank solvency, it is important to monitor bank profitability as well. Unfavourable values of ROA and ROE ratios, especially values lower than zero, are often related with poor asset quality and huge level of nonperforming loans and created loan loss provisions.

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<sup>4</sup> From the analysis made by the IMF (1998) arises that the real exchange rate appreciation is statistically significant 3, 8 and 13 months before the crisis - p. 95.

<sup>5</sup> For analysis of bank efficiency see for example Stavárek, D and Polouček, S (2004), 'Efficiency and Profitability in the Banking Sector'. In Polouček, S (ed.) 'Reforming the Financial Sector in Central European Countries'. Houndmills: Palgrave Macmillan, pp. 75 - 135.

- Rapid change in the structure of banks' assets and liabilities. It concerns maturity and currency mismatch between assets and liabilities, these mismatches creates the interest rate risk and currency risk. The greater the mismatch, the higher the risks and the greater the probabilities of future financial difficulties. Gonzáles-Hermosillo (1999) found that market risk and liquidity risk were generally important in determining bank distress and eventual bank failure.

Also bank-specific variables predicted crisis reasonably well in most cases, introducing macroeconomic variables generally improved their predictive power because both microeconomic and macroeconomic influences are important in determining banking crisis.

The following hypothesis will be tested in the fourth chapter:

- H1: before the crisis the real GDP growth starts to decline
- H2: before the crisis the consumption and investments start to decline
- H3: before the crisis the inflation rate starts to growth
- H4: before the crisis the exchange rate appreciates and than depreciates
- H5: before the crisis the credit contraction occurs
- H6: before the crisis interest rates increase steadily
- H7: before the crisis the capital adequacy ratio decrease
- H8: before the crisis the bank profitability decrease
- H9: before the crisis the level of nonperforming loans increases

### **Banking crisis in the Czech Republic**

The Czech banking sector has experienced two periods of the banking crisis in the 90's. The first period was connected with troubles of small and medium sized banks – it started in 1993 with forced administration of Kreditní a průmyslová banka Praha and continued with troubles of other small banks. The number of small banks decreased from 22 in 1993 to only 8 in 2002. 17 banks have lost their licence because of their bad financial situation<sup>6</sup>, the others because of mergers and sales. The share of nonperforming loans strongly exceeded both thresholds mentioned in the first chapter - see Table 1. Although the segment of small and medium sized banks has only 9 % share of the bank sector in 1993 the number of failure banks has substantially weakened public confidence in the banking sector.

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<sup>6</sup> 15 banks have problems with bad asset quality, 1 bank with liquidity. 1 bank has lost its licence due to frauds.

*Table 1 - Selected indicators of banking crisis in the Czech Republic*

	93	94	95	96	97	98	99	00	01	02	3Q03
Total banks	52	55	54	53	50	47	42	40	38	36	35
Big <sup>7</sup>	6	6	5	5	5	5	4	3	3	4	4
Small	22	21	18	12	9	3	9	8	8	8	8
Classified loans <sup>8</sup>	n.a.	36.5	33.1	29.3	26.9	27.1	32.2	29.8	21.5	16.9	12.3

*Source: Czech National Bank*

The second period of the banking crisis concerned troubles of big state owned banks. The share of nonperforming loans exceeded 30 % in 1999 (see Table 1) and strongly confirms the existence of systemic banking crisis.<sup>9</sup>

### **Early warning signals in the Czech Republic**

Speaking about macroeconomic early warning signals, these indicators are generally watched regularly so all data needed for the analysis are available in official statistics of Czech Statistical Office or in International Financial Statistics of International Monetary Fund. Table 2 shows the development of real GDP growth, level of consumption and investments, inflation measured by consumer price index and values of real effective exchange rate.

*Table 2 – Development of selected macroeconomic early warning signals<sup>10</sup>*

Indicator	93	94	95	96	97	98	99	00	01
GDP growth	92.3	94.4	100.0	104.3	103.5	102.4	102.9	106.3	109.7
Consumption	509.5	607.0	701.7	818.2	899.9	966.1	1019	1074	1157
Investments	289.6	339.8	442.5	500.6	514.5	535.5	528.3	561.4	610.9
CPI	83.3	91.6	100.0	108.8	118.1	130.7	133.5	138.7	145.2
Exchan. rate	92.1	96.7	100.0	106.6	107.5	116.3	114.7	114.8	121.3

*Source: International Financial Statistics of IMF*

According to the hypothesis defined in previous chapter (H1 – H4), before the banking crisis hit the position of the economy should be in the status of rapid end of a previous boom. However, data in the table about development of consumption and investments definitely do not testify hypothesis H2. The GDP growth was slightly lower in 1997 and 1998 (H1).

<sup>7</sup> Big banks are banks with total assets higher than 100 billions CZK

<sup>8</sup> Classified loans in percent of total loans

<sup>9</sup> For the analysis of causes of the Czech banking crisis see Vodová (2003)

<sup>10</sup> Real GDP growth, CPI and real effective exchange rate – index numbers (1995 = 100); consumption and investments in billions of CZK

Table 3 – Credits to private sector

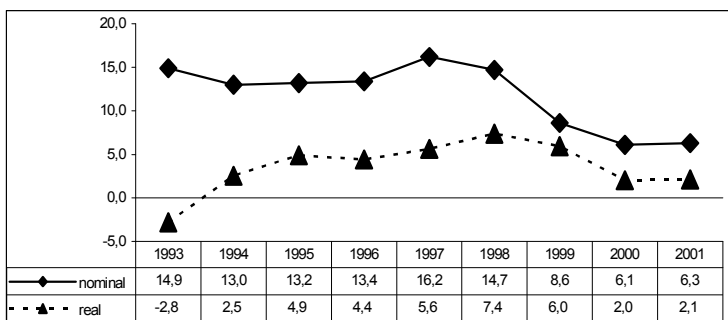
Credits	93	94	95	96	97	98	99	00	01
Billions CZK	508.7	683.2	1037	1159	1250	1176	1098	1029	916.4
In % of GDP	39.9	52.4	75.1	80.5	87.5	83.2	77.3	70.2	60.5

Source: International Financial Statistics of IMF; author's calculation

Before the crisis banks, after the previous rapid growth there should be the contraction of credits to private sectors (H5). Data in Table 3 confirms this hypothesis in case of systemic banking crisis (troubles of big banks): within first four years the absolute volume of provided loans has expanded more than twice and the share of credits on GDP has risen from 39.9 % up to 87.5 % in 1997<sup>11</sup>. After this peak has followed the contraction and banks have provided less and less loans. In last years, most banks orientate more on investments in securities and less on providing credits so the share of credits on GDP has fallen to 60 %.

Looking on development of nominal and real interest rates (see Figure 1), it is evident, that at the beginning of analysed period the existence of negative real interest rates was one of the factor standing behind bad financial situation of banks. Nominal interest rates have raised steadily till 1997 and this evolution confirm the hypothesis H6 about the role of interest rates as an early warning signal.

Figure 1 – Nominal and real interest rates<sup>12</sup>



Source: Czech National Bank and author's calculation

<sup>11</sup> Such a high amount of loans is the result of the fact that banks played a key role in process of transition from central planned to market economy and satisfied enormous demand for credits needed to privatization

<sup>12</sup> Annual average interest rates from new provided loans; real interest rates are deflated by CPI

When it comes to bank-specific (microeconomic) indicators, problems with available data arise, especially in case of data about currency and maturity mismatch. Nevertheless, some other applicable ratios remain.

The capital adequacy ratio has significantly decreased in 1996. This was caused partly by the change in methodology of capital adequacy calculation; however the greater role in the decline has played the gradually worsening quality of credit portfolios. The poor quality of credit portfolio has negatively influenced bank profitability: the average Czech bank ended its book with losses in 1997, 1998 and 1999. The values of the share of nonperforming loans have two peaks: the first one in 1994 (and since then this value has not been overcome), the second one in 1999. Both years correspond with peaks of banking crisis: in 1994 with troubles of small and medium sized banks, in 1999 with problems of big banks – see Table 4.

*Table 4 – Development of selected microeconomic early warning signals<sup>13</sup>*

Indicator	93	94	95	96	97	98	99	00	01
Capital adequacy	n.a.	11.2	12.4	10.3	10.6	12.1	13.2	14.8	15.4
Return on assets	n.a.	0.48	0.09	0.27	-0.17	-0.36	-0.25	0.68	0.73
Return on equity	n.a.	14.0	10.9	10.3	-3.5	-8.3	-5.3	13.1	16.6
Nonperform. loans <sup>14</sup>	n.a. <sup>15</sup>	36.5	33.1	29.3	26.9	27.1	32.2	29.8	21.5

*Source: Czech National Bank*

Speaking about the banking sector as a whole, the level of nonperforming loans seems to be rather good signal of forthcoming financial distress (H9), even in case of Czech Republic, where the share of nonperforming loans is strongly affected by the consolidation and stabilisation programs which should help banks. Slightly different is the situation in case of profitability ratios (H8): although in the period of 1993 – 1996 many small banks have failure, the banking sector as a whole has remained profitable. Surely, this was caused by the fact that the segment of small and medium sized banks has represented only 9 % share of the banking sector. The capital adequacy ratio in case of Czech Republic seems to be slightly less quality indicator (H7): its values are strongly influenced by capital injections to big banks before their privatization.

## Conclusion

<sup>13</sup> ROA, ROE and capital adequacy in percent; nonperforming loans in percent of total credits

<sup>14</sup> According to the arrangement of Czech National Bank, nonperforming loans concern watch, substandard, doubtful and loss loans. The classification is made according to the delay in repayment – 30-90 days in case of watch loans, 91-180 in case of substandard loans, 181-360 days in case of doubtful loans and more than 360 days for loss loans

<sup>15</sup> The methodology for loan classification was established in 1994



The aim of this paper was to characterise the role of early warning signals in measuring the vulnerability of countries to systemic banking crisis and to analyse how successfully these indicators have been able to predict the banking crisis in case of Czech Republic.

Microeconomic early warning signals seemed to be very good in predicting systemic banking crisis that means situation in which most of the banking sector is affected by financial distress. In case of Czech Republic in the period around 1998 when big banks have suffered by financial distress hypothesis 6 – 9 were confirmed. But when it comes to the first period of banking crisis (troubles of small banks around 1995) the predictive power of these signals was less consistent because the used indicators cover banking sector as a whole. Although this situation could not be marked as “systematic” it has strongly weakened the public confidence in banking sector and has negative influences as well.

Speaking about macroeconomic early warning signals (hypothesis 1 – 5), their predictive power was mixed in case of Czech Republic. As a Czech specific, the development of consumption and investments (H2) did not testify their predictive power, even in the period of banking crisis these two variables were growing. The indicator provided loans to private sector (H5) and the development of real GDP growth (H1) have given notice on forthcoming systemic banking crisis, not on forthcoming troubles of small banks again.

Time series of values of early warning signals are short for the present. Moreover, an early warning system contents such variables whose behaviour prior to the episode of banking crisis is systematically different from that during normal period but the analysed period was the period of economic transformation and it is difficult to say which values correspond to “normal period”.

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## Resumé

### EARLY WARNING SIGNALS AND ITS ROLE IN PREVENTING BANKING CRISES

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In den letzten Jahrzehnten erlebten viele Länder eine Bankkrise, zum Beispiel Mexiko (in den Jahren 1994 – 1995), die Länder in Südostasien (1997) und transitive Wirtschaften (in den neunziger Jahren des zwanzigsten Jahrhunderts). Es betrifft auch die Tschechische Republik.

Die Bankkrisen können durch eine ganze Reihe von Faktoren verursacht werden. Systematische Bankkrisen sind mit relativ hohen fiskalischen und ökonomischen Kosten verbunden und ihre Lösung ist überhaupt nicht einfach. Mit der Ausnutzung der Signale der rechtzeitigen Warnung ist es aber möglich, die bevorstehende Krise voraussagen. Diese Anzeiger bilden also nicht nur den Raum für rechtzeitige und angemessene Reaktionen der Wirtschaftspolitik, sondern können auch wie eine Prävention der Bankkrisen oder mindestens wie eine Milderung ihrer Folgen wirken.

In dem ersten Teil des Beitrags werden der Begriff Bankkrise und die Anzeiger der Bankkrise definiert. Der zweite Teil des Beitrags charakterisiert einzige Signale der rechtzeitigen Warnung, und zwar sowohl makroökonomische (die Entwicklung des Bruttoinlandsproduktes, des Verbrauchs, der Investitionen, der Inflation usw.), als auch ebenfalls mikroökonomische, also spezifische für jede Bank (das Niveau und Veränderungen in der Kapitalangemessenheit der Bank, die Entwicklung der eingeräumten Kredite, die Entwicklung des Anteils der klasifizierten Kredite, die Veränderungen in der Struktur der Fälligkeit der Aktiva und Passiva usw.). Es folgt die Charakteristik der Bankkrise in der Tschechischen Republik. Der letzte Teil des Beitrags umfasst die Entwicklung der Werte der Signale der rechtzeitigen Warnung in der Tschechischen Republik im Zeitraum vor dem Ausbruch der Bankkrise und es

wird analysiert, ob es möglich war, aufgrund der Signale die bevorstehende Krise voraussagen.

Pavla Vodová, 2004